Epitomes

Important Advances in Clinical Medicine

Ophthalmology

The Scientific Board of the California Medical Association presents the following inventory of items of progress in ophthalmology. Each item, in the judgment of a panel of knowledgeable physicians, has recently become reasonably firmly established, both as to scientific fact and important clinical significance. The items are presented in simple epitome and an authoritative reference, both to the item itself and to the subject as a whole, is generally given for those who may be unfamiliar with a particular item. The purpose is to assist busy practitioners, students, research workers, or scholars to stay abreast of these items of progress in ophthalmology that have recently achieved a substantial degree of authoritative acceptance, whether in their own field of special interest or another.

The items of progress listed below were selected by the Advisory Panel to the Section on Ophthalmology of the California Medical Association, and the summaries were prepared under its direction.

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Recent Developments in Radial Keratotomy

RADIAL KERATOTOMY is a surgical procedure designed to correct nearsightedness (myopia). During the procedure, the surgeon uses a diamond-bladed micrometer knife to make spoke-like partial-thickness radial cuts in the paracentral and peripheral cornea to produce corneal flattening, which reduces myopia. In the early 1980s the operation was growing in popularity but had not been formally tested. In 1981 the National Eye Institute funded the Prospective Evaluation of Radial Keratotomy (PERK) Study to investigate the safety and efficacy, predictability, and stability of radial keratotomy. The PERK results and those of other studies have shown that almost all patients become less myopic with few serious complications. Those with less myopia had better results four years after the procedure. Approximately 75% of patients in the PERK study had 20/40 vision—unrestricted driver's license vision—or better without glasses, and 64% wore no optical correction. The predictability of results for an individual patient has been less than desired, however. New technology and surgical techniques are improving the predictability, and, as a result, about 80% of operated eyes now fall within the ± 1.00 diopter range, the ideal result being mild residual myopia (– 0.50 diopters).

Based on results reported to date, the relative safety of radial keratotomy is documented. Severe vision-threatening complications have been rare, and the most common complications, although not insignificant, have been a loss of two or three Snellen lines of best corrected visual acuity. This occurred in 2.5% of the patients in the PERK study at four-year follow-up.

Surgeons doing radial keratotomy previously used 16 or more incisions; the PERK study used 8, and many surgeons are currently using 4 initial incisions. If an undercorrection occurs, the original incisions can then be lengthened or deepened, or additional incisions can be added. Further studies will be required to examine the effectiveness of these techniques in improving predictability.

All of the major radial keratotomy studies have reported the phenomenon of a continued progressive effect of the surgical procedure in some patients. From 15% to 31% of patients' operated eyes have had a continuing decrease of – 1.00 diopter or more—a change toward farsightedness—from one to four years after the operation. There is speculation that this is associated with wound healing, and some data support an association between an incisional depth of greater than 90% of corneal thickness and instability. Follow-up results beyond five years will provide useful information regarding this problem.

In the longer term, two technologic applications may improve radial keratotomy results and its predictability. By the use of finite-element computer simulation of the cornea, the theoretic results of radial keratotomy can be studied. The correlation of theoretic and experimental results will lead to a better understanding of the biomechanics of the cornea and to better surgical techniques. In addition, computerized imaging of the corneal shape, videokeratography, allows more detailed study of the optical properties of the cornea after the surgical procedure.

The second new technology is using excimer lasers to do corneal operations. Two strategies that use pulsed 193-nm argon fluoride ultraviolet lasers to remove submicron amounts of tissue are being investigated. Laser keratomileusis involves reshaping the anterior surface of the cornea. The laser can also be used to make linear excisions, as in standard radial keratotomy, but wound healing remains a problem.

Altogether, about 15 different corneal surgical techniques to correct refractive errors are being investigated, and the field remains one of the most active and intriguing in ophthalmology.

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REFERENCES

Hanna KD, Jouve FE, Waring GO 3d: Preliminary computer simulation of the effects of radial keratotomy. Arch Ophthalmol 1989; 197:911-918

McConnell PJ, Garbus J, Lopez PF: Topographic analysis and visual acuity after radial keratotomy. Am J Ophthalmol 1988; 106:692-695

Spigelman AV, Williams PA, Lindstrom RL: Further studies of four-incision radial keratotomy. Refractive Corneal Surg 1989; 5:292-295

Waring GO 3d: Development of a system for excimer laser corneal surgery. Trans Am Ophthalmol Soc 1989; 87:854-893

Waring GO 3d, Lynn MJ, Fielding B, et al: Results of the Prospective Evaluation of Radial Keratotomy (PERK) Study 4 years after surgery for myopia. JAMA 1990; 263:1083-1091

Current Uses of Collagen Shields

COLLAGEN SHIELDS are biodegradable contact lens-shaped films made of porcine or bovine scleral collagen. After placement on the eye, naturally occurring enzymes in the tear film cause the shields to dissolve over a 24- to 72-hour period, depending in part on the degree of collagen cross-linking induced at the time of manufacture. Their use as a clinical tool in ophthalmology is now widely accepted.